Library
20

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College of Agriculture — Agricultural Experiment Station
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FARM SCIENCE in WAR and PEACE

The Report of the New Jersey Agricultural Experiment Station for the Fiscal Year 1943-44

Second Installment - -

Presented herewith is a continuation of the annual report of the New Jersey Agricultural Experiment Station. The introductory statement by the Director and the chapter on Soils appeared in the last issue. The current number includes the Chapter on Plants and the first part of the chapter on Animals. The May-June issue will carry the remainder of the chapter on Animals and the chapter on Man.

A limited edition of the complete report will be off the press in June.

WHETHER he eats plants, or whether he consumes animals that have been nourished and fattened on vegetation, man is utterly dependent upon plant life to convert the constituents of the soil into food and fibre for his use. More efficient production of plants, therefore, is a fundamental step in increasing and diversifying the food supply and thus raising the standard of living.

PLANT BREEDING

Not content with taking plants as he finds them, the plant scientist is turning more and more to the development of new forms that will better serve the purposes of mankind. Plant breeding has given us new flavors and consistencies, higher acre-yields, greater resistance to insects and diseases, to frost and drought.

Asparagus

Among the dozens of plant-breeding projects under way at the Experiment Station, each year sees significant milestones in a few. A highlight of the year under review was the harvesting of some 15 pounds of seed of a high-yielding strain of asparagus developed through a decade of careful selection and cross-breeding at New Brunswick.

About 2,500 plants of this strain were planted on a cooperator's farm in the summer of 1941. The plants have made an excellent showing in uniformity of type and vigor. Some 1,500 one-year old roots of the same strain were planted on the Vegetable Research Farm the following year and another 600 in 1943.

When a few more seed blocks have been established, we believe the strain will be worthy of naming and introduction for commercial use.

Sweet Corn

Sweet corn, grown on some 23,000 acres, is one of New Jersey's leading vegetable crops. The hybrid sweet corn breeding program inaugurated in 1942 has been greatly increased in scope during the past year. Much of this work is being carried on in Burlington County, the heart of the sweet corn section of the state.

A survey of conditions in Burlington County indicated that the most serious problems facing growers of sweet corn were caused by insect infestation, diseases, and unreliable seed. Smut, wilt, and the European corn borer were particularly serious.

A corn breeding program can do much to put sweet corn production on a more profitable basis. During the past year more than 200 inbreds were tested for wilt resistance by means of artificial inoculation in the greenhouse. Inbreds showing susceptibility were discarded, leaving 168 to use in the breeding program. One hundred forty-two hybrids were made in 1943 on the breeding block in Burlington County and these hybrids are now under intensive study. Information is being gathered on the yield, quality, earliness, disease resistance, and other factors found in these new hybrids.

In addition to the program for the development of better hybrids, a hybrid seed production study is under way to determine the practicability of producing local hybrid seed. Two hybrids, Marcross and Old Hickory, are included in this study. The first year's results are very encouraging.

Atlantic Alfalfa

Atlantic alfalfa has been outstanding in its hay production capacity during the past 5 years in trials at the Experiment Station. It has consistently outyielded such varieties as Grimm, Kansas Common, Hardistan, Hardigan, and many others by as much as 500 pounds on the average of dry hay per acre each year. The characteristics which make Atlantic alfalfa superior are:

(1) It possesses a much branched root system which gives greater resistance to winter-heaving through better root anchorage;

(2) Average hay yields from this variety are 15 to 20 per cent greater than other common varieties with which it has been tested;

(3) It is longer-lived than most of the present commercial varieties;

(4) Seed is produced in abundance under favorable conditions, making it profitable for commercial seed purposes.

Foundation seed stocks of Atlantic alfalfa are being maintained at the Experiment Station. Foundation seed has also been sent to the West for increase purposes since seed crops are much larger and more certain in the West than they are in New Jersey. Seed of Atlantic alfalfa should be available for limited farm use in 1946.

Breeding Corn for Borer-Resistance

The corn borer is difficult to control by cultural means alone. Studies now underway promise some help through the breeding and development of borer-resistant hybrids.

In 1943, of 129 single-cross hybrids

Two good ears per stalk is one of the aims of the sweet corn breeding program.

tested at the Experiment Station, 8 showed superior yielding ability but only 4 of these showed low stalk breakage due to borer injury. In a similar test involving inbred lines, A47 showed considerable resistance to the borer. It has apparently transmitted this characteristic to New Jersey Hybrids, 2, 4 and 5, of which it is one of the parents.

Based on stalk breakage counts, under natural conditions, N. J. Hybrid No. 5 showed strong resistance with 7 per cent breakage as compared to 31 per cent for N. J. No. 2, and 33 per cent for No. 4. When corn borer eggs were placed on the leaves of these hybrids to increase the infestation, reductions in grain yields resulted as follows: N. J. No. 5, 11.4 bushels per acre; N. J. No. 2, 2.8 bushels per acre; and N. J. No. 4, 1.0 bushel per acre.

While N. J. Hybrid No. 5 seems to have considerable resistance to borer entry into the stalk, it is damaged more severely than either Nos. 2 or 4 when such borer entrance occurs. Hybrids Nos. 2 and 4, on the other hand, are fairly tolerant of a borer population within the plants.

Strawberries

Ten strawberry selections, outstanding for vigor, productiveness, and flavor, were listed for rapid propagation after the 1944 harvest season. The best of these will be named after further tests, provided no serious faults are observed. More than 40,000 seedlings have been studied since the breeding work began and 1159 have been given a second test.

Progress in the development of better varieties of everbearing strawberries was emphasized by the behavior of several selections which were especially vigorous, productive, and attractive during the fall of 1943. Three of these are being propagated for tests in various parts of the state.

Blueberries

The New Jersey Station is cooperating with the U. S. Department of Agriculture in breeding better blueberry varieties. About 50 selections from seedlings grown in New Jersey are now being given a second test and there are still some 5,000 seedling plants under first test in a five-acre planting near Weymouth. During the 1943 fruiting season a total of 32 varieties was marked for propagation. Rooted cuttings of these selections are now growing in the propagating frames and will be used to establish row tests on commercial blueberry farms. There has been a real need for very early and very late varieties and some of the seedlings now being propagated promise to fill that need better than anything previously available.

Peaches

The New Jersey Peach Council has already distributed more than 643,000 trees of Station-developed varieties ripening from the Golden Jubilee to the Afterglow season. In the spring of 1943, 29 different peach crosses were made from which 1,504 seeds were obtained. Fifteen different nectarine crosses were made and 471 pits obtained.

Fifty-three new yellow-fleshed peaches were selected during the summer of 1943 as having sufficient promise to be tested against the present list of commercial varieties. Twenty-six new white-fleshed seedlings also showed considerable commercial promise.

The Peach Council has requested a peach that will have color and shipping qualities equal to Sunhigh, to replace Summercrest. The Peach Council has further requested that an attempt be made to breed a yellow-fleshed commercial peach to ripen 1 week after Elberta and another 2 weeks after Elberta. Good progress is being made.

Rutgers Tomatoes

The steady increase in popularity of the Rutgers tomato is shown by the increased acreage and number of pounds of Rutgers seed (certified) produced in New Jersey since 1935. In 1935, 730 acres of Rutgers seed were included in a total certified acreage of 2,763. In 1943, 3,865 acres were planted to Rutgers out of a total of 5,504 acres. It is also interesting to note that out of 167,462 pounds of certified seed produced in New Jersey in 1943, 113,396 pounds were Rutgers.

Plant certification records in Georgia show that the certified acreage of Rutgers plants in 1940 was 1,418. In 1943, 4,847 acres were in Rutgers out of a total of 6,692 acres surveyed.

The majority of Georgia certified plants were shipped to Maryland, Virginia, Pennsylvania, New York, Ohio, Indiana, Michigan, Illinois, Wisconsin, and into Canada along the Lakes.

VARIETY TESTING

In addition to breeding new plant varieties, the Station is constantly testing varieties developed elsewhere for possible adaptation to New Jersey conditions. In the case of such a plant as peaches, winter hardiness is frequently the deciding factor in determining the usefulness of a new variety in this State.

Until recent years, the only way by which one could determine the relative hardiness of peach buds of different varieties was to await the appearance of a severe winter. Sometimes when that occurred, all peach buds were killed so that no measure of relative hardiness could be obtained.

In 1940, a method was developed at the New Jersey Station in cooperation with the U. S. Department of Agriculture by means of which freezing results with dormant peach buds could be obtained similar to what would be experienced out-of-doors at the same temperatures. This method is now used annually to determine the relative fruit bud hardiness of many varieties and seedlings during the winter months.

From December 20, 1943 to March 1, 1944, a total of 1,937 different peach twig and bud samples were exposed to freezing temperatures and a total of 194,236 fruit buds were sectioned and examined

Two bushes of the Rancocas variety. The bush on the left yielded 1.8 quarts a year for 5 years, with good care but no fertilizer; bush on right yielded 5.7 quarts a year for 5 years, with same care, plus recommended fertilizer.

AUG 1945

to determine the degree of injury. It had been learned during the winter of 1942-1943 that dormant buds of most of the common standard varieties of peaches on the Station grounds would resist a temperature of 5° to 8° below zero F. and still have enough buds remaining alive to produce a crop.

During the late summer and early winter of 1943, exceptionally dry weather was experienced and during the winter of 1943-1944, the dormant fruit buds of most peaches resisted temperatures of —9° to —11° and still retained enough live buds to produce a crop. When the buds had swelled slightly and had attained the so-called silver bud stage, most of them successfully resisted temperatures close to zero. After the buds had advanced to a point beyond the silver bud stage where portions of sepals and calyces were slightly exposed, most varieties successfully resisted temperatures of 7° to 8° when the rate of temperature fall was relatively slow.

A few of the hardiest named varieties throughout the winter and spring of 1943-1944 were Ambergem, Arp, Carman, Chili, Dewey, Duke of York, Rosebud, and Yellow Greensboro.

This New Jersey method for determining the cold resistance of fruit buds is of special value in determining the relative hardiness at different periods during the winter and the early spring season, for noting the comparative hardiness of the buds of different varieties, and relative hardiness of fruit buds on trees experiencing different nutritional and environmental conditions.

Tift Sudan Grass

Tift sudan grass is a new strain recently developed by the U. S. Department of Agriculture. The summary of trials for 2 years at New Brunswick indicates that this strain surpasses the production of ordinary commercial sudan grass by an average of 500 pounds to the acre.

This new strain appears more valuable for hay than for pasture purposes. It is somewhat slow in starting growth and this would mean deferring grazing longer than is necessary with commercial sudan grass.

Leaf spot diseases are the chief limiting factors in growing sudan grass for hay in New Jersey, since they cause severe leaf browning, resulting in loss of green color and reduction in yield. The Tift sudan grass is highly resistant to the leaf spot diseases, being almost free of them compared with 40 to 50 per cent contamination on sudan grass grown from commercial seed.

Vicland Oats

Extensive tests during the past 3 years show that Vicland, a new oat variety, is well adapted to the oat growing region of New Jersey. It has proved superior in grain production besides being early-maturing and resistant to disease and lodging. It also gives a heavier oat than other popular varieties. The straw yields are light because the plants are short, and this makes it a good variety to use for companion crop purposes in seeding down permanent hay or pasture crops, since it offers less competition to the young grasses and legumes by shading.

When good yields of grain are desired along with an abundance of straw the varieties Keystone, Swedish Select type, and Victory are satisfactory. These varieties will produce 30 per cent more straw than Vicland but Vicland normally produces a heavier oat and, therefore, better quality grain.

Wong Winter Barley

A new winter barley is challenging the leadership of such standard varieties as Maryland Smooth Awn, Nassau, and Tennessee Winter. Wong, an introduction from New York State, is a good yielder, stands well, and is resistant to the mildew disease. Besides producing excellent yields of grain it is a good straw producer. Further studies are in progress with this variety, especially as related to its winter-hardiness.

CULTURAL PRACTICES

Row-Spacing Affects Soybean Yields

Much has been written about row-spacing soybeans for maximum grain production. Such spacing will vary with the soil type, soil fertility, the rainfall, and the variety. Tests to determine the best row spacing for the two grain soybeans, Granger and Chief, were started in 1943. These two varieties were seeded in replicated rows ranging from 7 to 42 inches apart at 7-inch intervals. Granger is an early-maturing, short, much-branched type of soybean, whereas Chief is medium-maturing, tall, and almost non-branching.

Granger produced highest yields when grown in 7-inch rows, and a continuous decrease in yield resulted as row spaces were widened to 42 inches. The highest yield at 7 inches was 22 bushels per acre and the lowest yield at 42 inches was 12.5 bushels.

Yields from the Chief variety ranged from a high of 26 bushels at 14 inches to 18 bushels at 42 inches. Spacing rows 7 inches apart was too close to give maximum production with this variety.

Moisture tests of the grain taken in early October showed that rate of maturity was also related to row spacing. Chief soybeans planted in 42-inch rows contained only 11 per cent moisture at that time, whereas the grain from rows spaced 7 inches apart had almost 25 per cent moisture. If it is necessary to plant Chief beans late, maturity can be hastened by planting in rows.

Row-spacing also affected lodging. Chief Soybeans were most severely lodged in the 7-inch rows, much less in the 14-inch rows, and in the other spacings hardly at all.

You can't get a good variety down! Wong winter barley stood up where another variety couldn't take it in the 1943-44 variety trials at New Brunswick.

Irrigation for Potatoes

The use of portable irrigation on potatoes again proved its value by increasing potato yields an average of 37 bushels per acre in an experiment at Cranbury in 1943. This yield increase was obtained with only four irrigations. Rainfall records indicate that at least six irrigations should have been applied, and it is reasonable to believe that a much greater yield increase would have resulted if the potatoes had been irrigated six times.

It was also found that, for the most profitable returns under irrigation, Katahdins should be planted 10 inches apart in the row.

Timothy Hay Management

In a 3-year study of timothy hay production as related to fertilizer applications and cutting treatment some significant facts have been uncovered of importance in a permanent grassland type of agriculture. The following fertility treatments were used: (1) No treatment; (2) 400 pounds of 5-10-5; (3) 400 pounds of 5-10-5 plus 200 pounds of sodium nitrate in April; (4) 1200 pounds of 5-10-5; and (5) 400 pounds of 5-10-5 plus 200 pounds of sodium nitrate at early heading. All treatments were applied annually in the spring. Replicated plots receiving the above treatments were cut at three stages of development of the timothy plants: early heading; beginning bloom; and late bloom.

The highest yield from plots cut at early heading was an average of 2,286 pounds of cured hay from those plots receiving 1,200 pounds of 5-10-5 annually. The highest yield at the beginning bloom and late bloom stages was also obtained with this treatment, being 4,567 pounds and 6,123 pounds, respectively. All treatments gave significant increases over the control plots.

Among the most significant findings from this study are the tremendous increases in yield secured from those plots harvested at beginning bloom and late

bloom as compared to early cutting. It is well known that nitrogen applied at the early heading stage, as practiced in treatment 5 above will increase protein content without sacrifice of yield. It merits more wide-spread use on timothy hay fields than has been the case in past years.

As significant as the yields are the records on stand or persistency. Nearly all the timothy on those plots cut at the early heading stage for three years had disappeared, leaving in its place a stand of almost pure weeds. This indicates that timothy cut continuously at the early heading stage over a period of years is not strong enough to grow vigorously and maintain itself. In a permanent grass system of agriculture this is a highly important discovery. Present recommendations are to cut early for highest quality, but these results show that timothy will not persist over a period of years under this practice.

Highest yields and best quality timothy hay can be obtained by growing timothy on soil well supplied with lime and mineral nutrients, supplemented with nitrogen fertilizer in early spring and again at the early heading stage. The crop should be cut 10 to 20 days after the second application of nitrogen.

Grass-Legume Mixtures Excel for Hay

A 3-year study of grass-legume mixtures for hay shows great promise for new grasses being used in conjunction with alfalfa on fertile, well-drained soils. A mixture of bromegrass and alfalfa produced an average of almost 4 tons of cured hay per acre; alfalfa and orchard grass mixed was almost as good; alta fescue and alfalfa, and timothy and alfalfa were also very productive.

Other mixtures of less value were timothy and alsike, and timothy and red clover. The clovers, however, being biennials were somewhat at a disadvantage in these tests since the third year's cutting was nearly pure timothy. Nevertheless, the clover mixtures averaged slightly over 2 tons of cured hay per acre.

Mixtures distinctly inferior for hay were those in which ladino clover and birdsfoot trefoil were included. It is concluded that ladino is better for pasture than for hay and under the conditions of this test birdsfoot trefoil was not satisfactory for either hay or pasture purposes.

The yields of bromegrass, orchard grass, and timothy in mixture with alfalfa were equal to yields from straight plantings of alfalfa. In addition, the mixture of a grass with alfalfa has a number of distinct advantages, as follows:

(1) Grasses form a protective mulch for the alfalfa, thereby reducing winter-killing.
(2) If a poor stand of alfalfa is obtained the grass often provides good covering and insures a hay crop.
(3) The grass-legume partnership results in a higher quality grass hay since the legume shares with its grass partner the nitrogen it takes from the air.
(4) The grass contributes large quantities of organic matter to the soil and the legume furnishes cheap nitrogen to the farm either from decay of the legume roots in the crop rotation system, or from the manure resulting from feeding the alfalfa to livestock.
(5) Better erosion control is possible because the presence of a grass in mixture with alfalfa provides a denser and firmer sod, more resistant to water runoff than alfalfa grown alone.

Orchard Grass — Brome Grass — Reed Canary Grass

Three good grasses for use in New Jersey. They deserve more widespread use. (See Circular 492, published by the New Jersey Agricultural Experiment Station.)

New Grasses for Mid-Summer Pasture

The months of July and August are critical periods in the production of nutritious and palatable pasture herbage. Kentucky bluegrass pastures normally dry up and become unproductive, making it necessary for many dairymen to feed part of their winter supply of roughage and concentrate feeds. New grasses now under investigation bid fair to provide more pasturage during this danger period.

Many grasses have been tested for their growth during mid-summer and a number have been found to be greatly superior to Kentucky bluegrass. Rated in order of vigorous mid-summer growth on a fertile upland soil, these grasses are: Tall oat grass, orchard grass, bromegrass, reed canary grass, alta fescue, Kentucky bluegrass, and timothy. Tall oat grass is especially vigorous, making a return growth equal almost to alfalfa.

Better pasture mixtures, using some of these grasses in conjunction with one or more fast-growing legumes, are already being successfully used by some New Jersey dairymen. Such mixtures are equally adapted and valuable for hay or grass-silage purposes.

Mid-Summer Hay

A mixture of soybeans and sudan grass is one of the best emergency summer hay crops. In a 4-year test sudan grass and soybeans mixed yielded an average of 5,532 pounds of 10 per cent protein hay for a return of 553 pounds of protein per acre each year. Soybeans grown alone were almost as valuable, with the average production of cured hay being 4,795 pounds, containing 11 per cent protein, thus yielding 527 pounds of protein per acre. Sudan grass alone averages 5,050 pounds per acre but the protein content of the hay was only 9 per cent. Cowpeas produced an average of 3,187 pounds of cured hay per acre.

Mid-summer hay crops offer a means of securing feed when permanent hay or pasture crops fail. They are also versatile enough so that they can be used for pasture if not needed for hay.

Since these crop seeds are sensitive to cold, they should not be planted until after May 15 in South Jersey and May 25 in North Jersey. Plantings may be made up until early July with good chances of getting a hay crop.

The most important feature in handling mid-summer crops is the time of harvest. The stems of sudan grass and soybean plants are thick and cure slowly at best. Good curing weather is essential and, therefore, the crop should be cut sometime during the last two weeks in August. It should be cured in the swath for one or two days and then raked into windrows to insure saving the leaves.

Supplementary Hay

In a 4-year test of oats with various legumes for hay it was found that a mixture of winter vetch and oats was most productive. This mixture produced, on the average, 4,249 pounds of cured hay per acre. The hay analyzed 9.6 per cent protein, resulting in an average production of 408 pounds of protein per acre. Mixtures of field peas and spring vetch with oats were little better than oats

grown alone with average yields of about 3,600 pounds of hay per acre, containing 7.5 per cent protein and yielding about 270 pounds of protein per acre.

The spring hay crop should be sown as early as a good seedbed can be prepared, since late seedings result in corresponding decreases in yield. A mixture of 1½ bushels of oats with 30 pounds of winter vetch has given best results. The vetch seed can be mixed with the oats and the mixture planted with a grain drill. It should be cut for hay promptly when the oat seeds are in the milk stage. This is also a valuable mixture for grass-silage.

Plant Spring Oats Early

Oats is a crop adapted primarily to a cool season. This means that oats must be planted early to be grown with good success in New Jersey. Tests conducted during the past 5 years show that a 10-day delay in planting in April resulted in a 10 per cent reduction in grain yield, and a 20-day delay decreased grain production by more than 30 per cent. A similar, although not as pronounced, reduction in straw yield occurred.

Oats should be planted as early in the spring as it is possible to prepare a good seedbed. Cold spells in April are not severe enough to reduce germination nor to injure young seedlings and need be no cause for delaying plantings. In addition to an increased yield from early plantings, heavier grain with a better test weight is secured, thus improving the feeding quality.

Early plantings of oats, together with the use of an early-maturing variety, such as Vicland, will improve quality and increase yields of this valuable grain crop.

Sweet Potato Storage

Tests conducted during the past 3 years have shown that the bruising of sweet potatoes at harvest time increases the likelihood of loss from soft rot. This is especially true when such potatoes are stored in rooms where the temperature ranges from 60 to 70°F. Where the temperature is maintained at 80 to 85°F. and the relative humidity held at approximately 90 per cent during the curing period, the losses from soft rot are reduced to a minimum.

Seed Testing

A plant can be no better in quality than the seed from which it comes, and one of the important duties of the Experiment Station is the testing of seeds and of legume inoculant cultures offered for sale in the State. Some 9,000 to 10,000 separate tests are made annually in pursuance of this duty, and unsatisfactory stocks are ordered removed from the market.

Many requests come to the laboratory each year for information concerning the harvesting and storing of seeds, the location and availability of special types and qualities of seeds, the identification of seeds and weeds.

Boosting Greenhouse Tomato Yields

Studies with the use of growth substances (plant hormones or hormone-like materials) sprayed onto tomato blossoms to supplement natural pollination have shown this practice to be practical and advantageous in greenhouse tomato production. Tomato plants sprayed with some growth substances yield 10 to 15 per cent more fruits than those given the usual hand-pollination treatment.

Although seedless tomatoes usually are smaller in size than seeded fruits, those treated with growth substances to supplement pollination generally are somewhat larger and more uniform than hand-pollinated ones.

One of the growth substances found most effective for this purpose is 2,4 dichlorophenoxyacetic acid. A crop of greenhouse tomato plants treated with this material requires very slightly less labor than the common pollination practice and usually produces up to 15 per cent greater yields than the latter.

A second growth substance, beta-naphthoxyacetic acid, is very effective in supplementing natural pollination. The use of this material requires slightly more labor than the usual pollination practices, but the increased yield usually warrants the additional labor.

For satisfactory sets of fruits from the use of growth substances, it is necessary that tomato plants be forced to make vigorous growth with thick stems, and thick, dark-green leaves. Plants that are too "hard," with yellow-green leaves and relatively thin stems, often fail to set fruit when their blossoms are sprayed with growth substances.

A Cover Crop for Blueberries

In spite of several unfavorable conditions, a cover crop may be used in blueberry fields to conserve the soil. This land is especially acid, pH 4 to pH 4.8 if it is good blueberry land, and will not support legumes. By testing plants that are acid-tolerant, it has been found that a stand of oats can be obtained if shown about August 20 and properly fertilized. It was necessary to find a crop that would make growth in September and October to be of value and then be killed by the frost so that it would not attract deer in the spring. Deer are very numerous in the blueberry district and devour great numbers of fruit buds when in the berry fields.

Light Intensity Influences Yields

Because of the high degree of control over growth that is possible when plants are grown by gravel culture, this method is being used to study the nutrient requirements of several greenhouse crops. The extremely complex nature of soil makes this medium very difficult to use for such studies. Already the knowledge concerning nutrient needs that has been ascertained from gravel culture has led to substantial increases in yields when applied to soil-grown greenhouse crops.

Experiments of several years' duration have shown that rose plants in gravel culture absorb only approximately half the amounts of nutrients, and produce about half the number of flowers per month during the period from November 1 until March 1, that they do during the remainder of the year. Similarly, the amount of daily light reaching the plants during the late fall and winter months is only about half that of the average for the remainder of the year.

Recent studies with carnations in gravel culture have shown a remarkably close relationship between seasonal light intensity and flower production. Thus, both the yields and the average daily illumination value for the late winter and spring of 1944 were 13 per cent below those of the same period in 1943.

Rooting Geraniums

The geranium is one of the most popular pot plants grown by commercial greenhouses in New Jersey. For a long time it has been customary to root geranium cuttings in sand, then place the rooted cuttings in soil in 2¼-inch pots. Many years ago the cuttings were rooted directly in soil, but this practice was abandoned in favor of rooting in sand because the use of the latter medium resulted in less loss from rot.

Recent investigations at this Experiment Station have shown, however, that unfavorable results from the direct rooting of geranium cuttings in soil are due primarily to the following causes: (1) the use of poorly aerated and dense potting soils, (2) the presence of excessive amounts of nitrogen in heavy soils, (3) the use of cuttings of soft growth status, and (4) the lack of adequate root-promoting substance available to the cuttings.

It has now been adequately demonstrated that potting soils comprising 2 parts of composted soil, 1 part of limed peat, and 1 or 2 parts of sand, depending on the texture of the composted soil, are well suited for the direct rooting of geranium cuttings. Moreover, the use of a commercial root-promoting preparation enables geranium cuttings to root just as quickly in soil as in sand.

The elimination of the sand propagating bench in rooting geranium cuttings will save many hours and dollars for New Jersey florists.

PEST CONTROL

New Insect Problems

During the year under review two important insect problems have arisen in New Jersey.

The potato tuber worm, *Gnorimoschema operculella* (Zell.), an insect which heretofore had been absent from New Jersey, became established in 1943 and caused severe damage to potato tubers in localized

areas in southern New Jersey. Surveys in 1944 have established the fact that the insect is able to survive New Jersey winter conditions and serious trouble may be expected if climatic conditions are favorable for tuber worm development. Severe infestations have been observed on eggplants as well as potatoes.

Although the wheat-head armyworm, *Protoleucania albilinea* (Hbn.), has been known to occur in New Jersey, according to our records the most widespread damage ever caused by the species occurred in the spring of 1944 on barley and wheat. Observations in wheat and barley fields in southern New Jersey show that from 50 to 80 per cent of the crop in the infested fields was destroyed by this insect.

Helping Farmers Get Insecticides

When the war began our sources of supplies of some of the important insecticides were seized by the enemy. We not only lost our source of these insecticides but the demands of the armed forces have required a large part of the available supplies. These combined factors have created a very serious shortage in pyrethrum and rotenone products for agricultural uses. In order to stretch the available supplies a cooperative program between the Federal Bureau of Entomology and Plant Quarantine and the various State experiment stations on pre-determining the needs of the various localities before the insect problems become acute has made it possible to shift supplies of the critical insecticides from one section of the country to another to meet the demands of the various districts.

This cooperative effort has greatly benefitted New Jersey growers. For example, in one area of the state rotenone supplies were very low and serious insect damage threatened to occur. When the needs of this particular area were known we were able to get immediate shipments of rotenone in the area and loss from insect damage was prevented. A similar situation was encountered with nicotine, and after learning our needs the War Food Administration and War Production Board allocated nicotine supplies for the area.

Progress in Codling Moth Control

The codling moth, one of the most destructive fruit insects in the country, has been a serious threat to the New Jersey apple industry. Recent experiments and experiments now in progress indicate that DDT (dichlorodiphenyl trichlorethane) may become an important weapon against this serious fruit pest. The results on early-maturing varieties of apples show that DDT at the rate of 1 pound to 100 gallons of water is 10 to 15 times more efficient than the regular arsenate-of-lead program. Before we permit our hopes to rise too high, however, it is necessary to have all the facts regarding the effects of DDT on the apple tree and on the consumer of the apples sprayed with it.

This material also gives outstanding promise as an insecticide against the Oriental fruit moth.

Protecting Newly-Set Tomato Plants

Transplanted seedlings undergo a tremendous shock when they are pulled from the plant beds and transplanted to the field. To lighten this shock plants should be given every care possible. In case of tomato plants, especially in southern New Jersey, they are seriously affected by such foliage-feeding insects as the Colorado potato beetle and potato flea beetle.

During the past 2 years a study on methods of protecting newly-set plants against the ravages of foliage-feeding insects has been in progress. Although we have had only 2 years' experience with this type of protection, five experiments in various parts of the state indicate that southern-grown, as well as home-grown, plants can be dipped in a spray mixture before transplanting with promising success from the standpoint of protection against insects as well as against drying out of the foliage.

Although a fairly large number of insecticides have been tested, a dip composed of ½ pound of acid lead arsenate in 15 gallons of water plus enough summer oil emulsion to give ¼ of 1% actual oil in the mixture, is the most promising mixture tested to date. There is some evidence that the small amount of summer oil emulsion reduces transpiration, thus giving the plants a greater opportunity to become established in their new location.

Pea Aphid

Peas have been considered a very uncertain crop for New Jersey conditions for many years. During the past 5 years, however, we have accumulated data which show that good crops can be grown provided the peas are protected against the ravages of the pea aphid. Also during this period extensive experimentation on methods of combatting the aphid has demonstrated the merits of rotenone sprays and dusts and also combinations of rotenone and nicotine. Although nicotine is a very toxic insecticide, it does not possess the residual action of the rotenone materials. Rotenone insecticides do not give immediate spectacular results but they do stop the insects from feeding immediately and after a few days the aphids are completely destroyed. Throughout the course of these studies the untreated check plots have been worthless while the plots on which pea aphid control was effected show excellent yields of high-quality peas. Pea aphid control is very reasonable in cost and the growers cannot afford to take chances on escaping aphid infestations.

European Corn Borer

Much has been said and written about the European corn borer on corn. This insect is becoming of increasing importance to New Jersey agriculture. Since the corn borer first became established in New Jersey the annual infestations continue to increase and as yet we have no indication that the peak of abundance has been reached or is in sight. Because of the increasing abundance of corn borer our efforts to find means of curbing its damage have been increased. New types of insecticides have been tested against the corn borer on sweet corn and promising results have been obtained, even with a reduced insecticide program.

Experiments are now under way to determine the effects of European corn borer infestations on potato yields. Experiments are also under way on the possibility of re-arranging the potato pest control program in such a way as to prevent or reduce infestations in the potato crop.

Oriental Fruit Moth

A cooperative experiment between the Experiment Station, the State Department of Agriculture and the Peach Industry Committee of the New Jersey State Horticultural Society has been established to determine the effectiveness and the efficiency of parasites in controlling Oriental fruit moth. Prior to 1943 we had no means of producing parasites in quantity early enough in the season for liberations on the first generation of the Oriental fruit moth. Consequently, all previous work has been based on liberations with parasites against the second and third generation of fruit moth.

Several years' study of this problem shows that the Oriental fruit moth infestation in ripe peaches can be materially reduced by the important larval parasite, *Macrocentrus ancylivorus*. One of the most important purposes of the present experiment is to determine the efficiency of the parasites when liberated against the first generation of the Oriental fruit moth. Although it is too early to draw definite conclusions we have indications that a reduced number of parasites liberated on the first generation of moths may be as effective as a larger number liberated against the later generations.

Spray Coverage of Apple Trees

Studies on the completeness of spray coverage in apple orchards show that many growers do not apply their sprays evenly on the trees. In some cases, as much as 70 per cent more spray was applied to the lower sections of the trees than to the top sections, and as a result, a heavy infestation of insects and diseases was found in the top sections of the trees. There was not much correlation between the method of spraying and evenness of coverage in the tops and bottoms of the trees. Even distribution of spray materials appears to depend on the efficiency of the man applying it, rather than on the method used.

Arsenical Injury

The problem of arsenical injury to fruit

trees from spray materials has been serious in many orchards. In a laboratory experiment the spray materials, such as skim milk powder, hydrated lime, arsenate of lead, and sulphur, were added to water in various orders, and the mixture after standing for a short time was analyzed for water-soluble arsenic.

The experiments were repeated, using different types of sulphur and other fungicides.

The study showed that the order of mixing has not so much effect as the individual constituents of the spray material upon making the lead arsenate become water soluble. It was found that lime-sulphur caused the greatest amount of water soluble arsenic, and that the lime caused a reduction of the solubility of the arsenic. Additions of manganese sulphate and zinc sulphate also caused a reduction in arsenic solubility, provided lime was also present. When bordeaux mixture is to be made in the spray tank, the copper sulphate and lime should be added before the other constituents.

Blueberry Stunt

The rapidly expanding blueberry industry of New Jersey is menaced by "stunt," a virus disease for which control methods have not yet been demonstrated. This problem is being attacked in active cooperation with the U. S. Department of Agriculture. The project is in charge of a pathologist from the latter Department, who is working to define the symptoms of stunt on different varieties of blueberries and at various seasons of the year; to identify distinct strains of this and other viruses on blueberries; and to determine the rate of spread of stunt in the field under various conditions.

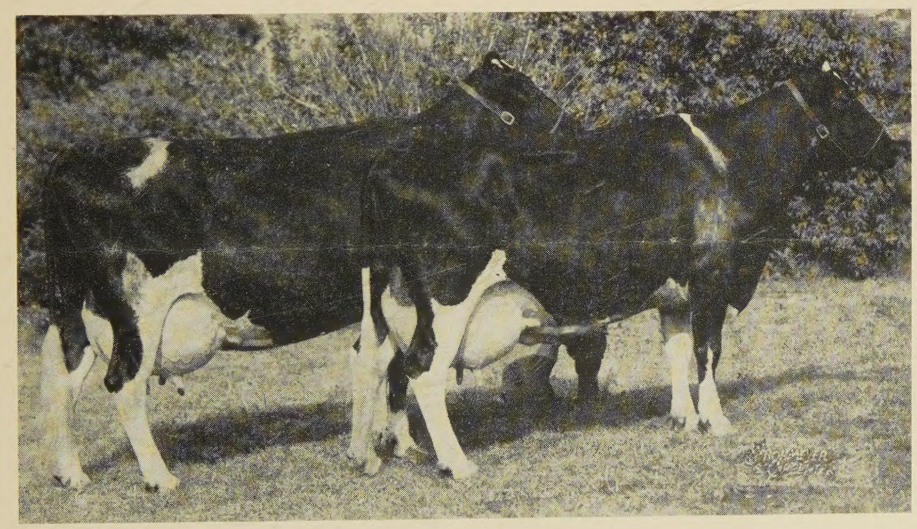
The Blueberry Research Laboratory has concentrated much of its effort on finding a control for stunt. Tests are under way to discover possible insect vectors. A spray mixture has been compounded that, when applied to diseased bushes, will kill any insects present and will also kill the foliage and roots of the bushes so that they can no longer serve to spread the disease. Roguing programs are being carried out in several fields to determine the effectiveness of this method of control. Field schools have been held to teach growers to inspect and rogue their own fields.

Blueberry Weevil

Blueberry weevil was more destructive in unsprayed fields in 1944 than for many years back. This offered an especially good opportunity for checking on a large scale the effectiveness of the spray treatment recently recommended by the Blueberry Laboratory. Spraying accomplished control in all cases known or reported. In one field where less than a half-crop had been obtained every year for the past five years, the pest was thoroughly cleaned up and a crop of 100 bushels to the acre was harvested.

Saving Copper

Because of a threatened shortage of copper fungicides brought about by the war, an experiment was conducted using reduced quantities of copper sulphate in bordeaux sprays for potatoes. It was found that concentrations of bordeaux sprays ranging from 6 to 8 or 10 pounds of copper sulphate with 10 pounds of hydrated lime per 100 gallons of water were equally effective in repelling insect pests of potatoes, and produced equal yields. No diseases were encountered during the test, but experimental work in other states indicates that bordeaux mixtures containing 8 pounds of copper sulphate to 100 gallons of water will give adequate protection against early and late blight, provided the plants are thoroughly covered at proper intervals. The use of 8 instead of the customary 10 pounds of copper sulphate to 100 gallons of spray would save approximately 150 tons of copper sulphate per year on New Jersey potato farms.



These cows—two of the outstanding individuals in the Experiment Station herd at Beemerville—produced a total of 149,520 pounds of milk and 5,487 pounds of butterfat in their first five lactations. They have each had five calves from artificial insemination.

ANIMALS

MORE than a score of breeds of warm-blooded animals may be found in the barns, pastures, ranges, and laboratories of the Experiment Station, reflecting both the diversity of agricultural pursuits in New Jersey and the breadth of the supporting research program. Four-footed species range from cows and steers to laboratory rats and guinea pigs; feathered species include pigeons, turkeys, and various breeds of chickens. Greatest attention, naturally, is given to cows and chickens, which represent the state's two leading types of farming.

Among the services rendered to all branches of livestock farming is the continuous inspection of commercial feeding stuffs offered for sale in the state. Matching the wartime increase in farm production, the year's records show total sales of 597,000 tons of feeding stuffs for the 1943 season, the largest tonnage on record.

Wartime shortages of many feeding materials complicated the task of the manufacturer and necessitated considerable latitude in enforcement of the feed control laws. Manufacturers were permitted to substitute ingredients in their registered feeds, so long as correct guarantees were attached to the feeds as sold. Failure to change these guarantees to correspond with changes in feed composition was probably the largest single factor responsible for the deficiencies found in 312 of the 1,297 official samples examined during the year.

DAIRY CATTLE

Inbreeding vs. Outbreeding

Some of the practical applications of our attempt to improve Holstein cattle through various methods of breeding were summarized during the year. In a recent publication (Bulletin 712) we reported that butterfat test can be increased without reducing production. This should be good news to dairymen who no doubt will be expected to produce high-testing milk when the stress of war demand for milk is returned to normal. The study also revealed a remarkable ability of certain females to transmit many characteristics, including milk with high fat percentage, to their progeny, irrespective of the sires used.

The primary contribution of the inbreeding work, thus far, lies in the development of superior sires. These sires, because of their inbreeding and selection, have apparently had fixed in their germ plasm a high degree of prepotency for high test, and are able to pass this on to their progeny with twice the rate of their outbred brothers. Such sires are invaluable in our artificial breeding program, as dairymen are assured of definite increase of fat percentage among cows in their herds that are descended from these inbred bulls.

Artificial Breeding Pays

A fat production increase of 14 per cent and a milk production increase of 9.3 per cent have been noted in the first generations of artificially bred heifers in New Jersey. One hundred and twenty heifers owned by 112 members of New Jersey cooperative breeding associations gave 734 pounds of milk and 42.2 pounds of fat more than their mothers at the same age.

The ability of Holstein sires to transmit increased fat percentage to their daughters is reflected in the 14 per cent increase in fat compared with the 9.3 per cent increase in milk.

This inherent factor for increased test has been developed by the Station's Holstein breeding experiment at the Dairy Research Farm.

Rental Plan for Bulls

Directors of New Jersey's Artificial Breeding Unit No. 1 have now been operating nearly a year on a base rental plan for lease of herd sires, recommended by the Experiment Station. Under this plan the base charge for selected proved sires is $3 per semen sample collected by the technician at the breeding unit. To this basic charge is added a further allowance based upon the average production of the sire's daughters, compared to the breed average for age and type of record. In the New Jersey Breeding Unit this extra allowance is 10 cents for each percentage point by which the daughters' records exceed the breed record. For example; if the daughters of a bull average 450 pounds of fat and the breed average is 410, then dividing 450 by 410 we get 109, or 9 per cent above the breed average. Thus the total charge should be $3.90 per sample semen. Unproved bulls are being leased on the basis of their pedigrees, allowing for age and records shown in the first two generations of the ancestors.

This method of lease places emphasis on performance, and a sire earns according to his ability to produce progeny of high quality.

Mastitis Resistance May be Inherited

In a study of the existence of mastitis in two cow families at the New Jersey Station, evidence was found to support the theory that some cows are more susceptible to this infection than others.

Under the same conditions one family of six cows including a dam, two daughters, and two granddaughters were infected 39.3 per cent of the milking time. On the other hand, family 247 composed of the dam, four daughters, and two granddaughters were infected only 10 per cent of the milking time.

Bang's Disease Control

During the past year the Bang's disease studies have been increased in scope. Following an outbreak of this disease on the Dairy Research Farm at Sussex, a program of adult vaccination was instituted in this herd. Using a method which was reported by another state, research workers injected a small amount of the strain No. 19 vaccine into the skin of the adults instead of using the larger dose under the skin—the method which has been recommended for calves.

Although it is too early to draw any definite conclusions, results at the end of the first year indicate that this method has afforded some protection against the disease. Also the animals treated by this method are returning to negative at a more rapid rate than would be expected when the large dose is injected under the skin.

Attempts are under way to develop a new method for measuring the immunity imparted to the animals by the vaccination.

Growing Dairy Replacements

As the result of winter feeding experiments to study growth response and pasture experiments to study this same problem in raising dairy replacements, some interesting conclusions have been reached:

(1) It takes a lot of expensive grain to fatten a yearling heifer;

(2) Feeding a yearling heifer all the good silage and hay she can consume produces good growth and thrifty condition, but not a fat animal;

(3) When these animals are turned out on good pasture in the spring the fat yearling declines in weight rather rapidly for the first month, whereas the growthy, roughage-raised yearling gains in weight and condition rapidly;

(4) Good roughage plus good pasture produces the most economical replacements. No poor quality roughage is good enough for any dairy animal, be it heifer, cow, or bull.

Alfalfa Silage Preserved with Corn Meal

An experiment was conducted to determine whether it was possible to make a complete ration out of alfalfa silage preserved with corn meal, and field-cured hay. The nutrients needed to maintain a thousand-pound cow producing 40 pounds of 4 per cent milk were calculated. It was found that 480 pounds of corn meal had to be added per ton of green alfalfa so that when 50 pounds of silage was fed with 10 pounds of hay the calculated requirements could be met.

From previous experimental work reported in the literature it was assumed that corn meal in going through the ensiling process lost none of its feeding value. Because of this report the experiment was established.

The silage was of excellent quality but when fed at the rate of 50 pounds a day with 11 pounds of mixed hay it was impossible to hold a 40-pound average production. Further chemical studies showed a loss of more than 10 per cent of the nutrients in the corn meal in addition to the normal silage fermentation losses.

When using corn meal as a preservative for grass silage it is not economical to use more than 250 pounds per ton of green alfalfa. At this level the nutrient loss within the corn itself is held within the range of normal fermentation losses in the ensiling process, and the silage is of excellent quality.

Tests of protective coatings for cement silo staves against the destructive action of silage acids now include more than 50 materials. Most of these have been exposed to at least four filling cycles. Coatings include special cements, a range in types of varnish and enamel, oils, phenolic resins, coal tar, and asphalt derivatives. No material tested to date has given perfect results. Coatings that are at all sticky result in silage adherence and the subsequent removal of large patches of coating. Penetrating type coatings resist the mechanical and chemical action of silage somewhat better than surface treatment. In many cases, failure of coating was caused by initial failure of the cement wash coat used originally as an inside finish for the silo. This suggests the possibility that protective coatings might better be applied directly to the staves, in which case they should be of such a nature as to seal the pores thoroughly. It seems desirable to plan on renewal of protective coatings at intervals of three to four years rather than to depend on indefinite coating effectiveness. Of those tested, the acid-resistant varnish-type enamels and raw linseed oil seem to represent the two leading treatments.

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